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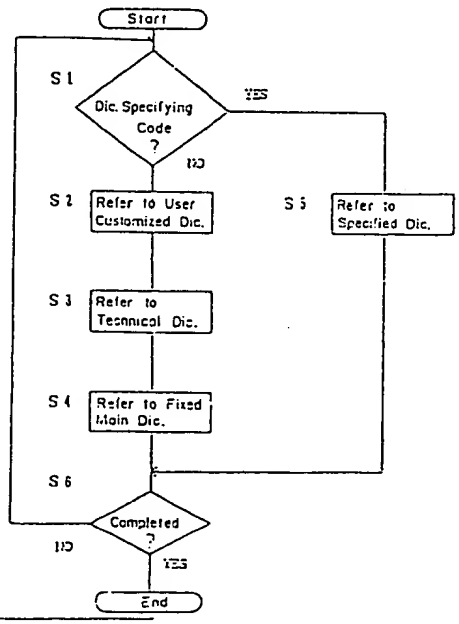
(54) Computer assisted language translating machine.

(57) A computer assisted language translating machine which comprises a morpheme analyzer for separating a source language sentence into morphemes with the use of dictionaries; a syntax analyzer for analyzing the syntax of a string of the morphemes with the use of a dictionary and grammatical rules; a converter for converting a syntactic structure of the input sentence into a syntactic structure of the target language; and a sentence generator for generating a translated sentence according to the syntactic structure of the target language converted by the converter. A code input unit is provided for inputting a dictionary specifying code to one of words which requires the use of a particular one of the dictionaries, utilized by the morpheme analyzer for dictionary referencing, when being translated into a target language counterpart. A discriminator determines whether or not the dictionary specifying code has been affixed by the code input means to such one of the words. A dictionary referencing unit is operable, when the discriminator determines that the dictionary specifying code has been affixed to such one of the words, to make reference to such particular one of the dictionaries and also operable, when the discriminator determines that the dictionary specifying code has not been affixed to such one of the words, to make reference to all of the dictionaries according to a predetermined system dictionary referencing sequence.

Fig. 10



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Description

COMPUTER ASSISTED LANGUAGE TRANSLATING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a computer assisted language translating machine capable of providing a translated output as quickly and accurately as possible.

2. Description of the Prior Art

Where a source language is to be translated into a target language with the use of the computer assisted language translating machine, information retrieval is carried out making reference not only to the fixed main dictionary, but also to a fixed technical dictionary which is filled with technical terms in one or more particular fields of science and a user customized dictionary which is filled by the user or operator with words peculiar to the user's business. During the operation of the translating machine, the information retrieval performed by the computer system is first made to the user customized dictionary, then to the fixed technical dictionary and finally to the fixed main dictionary, to find an appropriate word in the target language which corresponds to a word in the source language inputted by the user from the keyboard. In other words, the sequence of dictionary referencing performed by the computer system used in the translating machine begins with the user tailored dictionary followed by the technical dictionary and finally by the fixed main dictionary.

This dictionary referencing sequence appears to be appropriate in most cases. However, where an operator of the translating machine wishes to have the translating machine choose a particular one of an available number of target language words all equivalent to one particular source language word, the above discussed dictionary referencing sequence often becomes inconvenient. Considering a language translation from English into Japanese, an English word "book" may be translated into some Japanese words, for example, "HON" (expressed by a Chinese ideographic character or Kanji) and "BUKKU" (expressed by Japanese syllabary characters or Kana), both meaning a bound set of printed sheets of paper. In an ordinary sense, "HON" is a widely accepted word of Japanese origin and, therefore, is usually registered in the fixed main dictionary, whereas "BUKKU" is a limitedly accepted Japanese word transliterated from the English word "book" in terms of a phonetical representation and is, therefore, usually registered in the user customized dictionary.

If the prior art dictionary referencing sequence discussed above is employed under these circumstances, it may happen that a certain source language word may be translated into an equivalent target language word not called for by the operator of the translating machine. In the example of English-to-Japanese translation illustrated above, assuming that the operator of the translating machine wishes to have the English word "book" translated into an equivalent Japanese word "HON", the dictionary referencing according to the prior art sequence would result in a translation of the English word "book" into another equivalent Japanese word "BUKKU". Once this occurs, the translation of "book" into "BUKKU" may be often considered by an erroneous translation.

Thus, with the prior art computer assisted language translating machine, the translating machine would not necessarily provide an accurate language translation at all times and, once such an erroneous translation occurs, the operator has to exercise a revision, requiring a relatively prolonged time to complete the translation job.

SUMMARY OF THE INVENTION

The present invention has been developed with a view to substantially solving the above described disadvantages and has for its essential object to provide an improved computer assisted language translating machine which wherein a dictionary specifying code is added to the source language text so that the system can recognize one of the dictionaries which is to be utilized for the actual dictionary referencing to accomplish a quick and accurate translation from a source language word into one of equivalent target language words that is contained in the dictionary specified by the dictionary specifying code.

According to the present invention, there is provided a computer assisted language translating machine which comprises a morpheme analyzer for separating a source language sentence, entered in the translating machine, into morphemes with the use of dictionaries; a syntax analyzer for analyzing the syntax of a string of the morphemes, which have been separated by the morpheme analyzer, with the use of a dictionary and grammatical rules; a converter for converting a syntactic structure of the input sentence, analyzed by the syntax analyzer, into a syntactic structure of the target language; and a sentence generator for generating a translated sentence according to the syntactic structure of the target language converted by the converter.

To accomplish the above described object of the present invention, the computer assisted language translating machine also comprises a code input means for inputting a dictionary specifying code to one of words which requires the use of a particular one of the dictionaries, utilized by the morpheme analyzer for dictionary referencing, when being translated into a target language counterpart, said dictionary specifying code being used to specify such particular one of the dictionaries; a discriminating means for determining whether or not the dictionary specifying code has been affixed by the code input means to such one of the words; and a dictionary referencing means operable, when the discriminating means determines that the dictionary

specifying code has been affixed to such one of the words, to make reference to such particular one of the dictionaries and also operable, when the discriminating means determines that the dictionary specifying code has not been affixed to such one of the words, to make reference to all of the dictionaries according to a predetermined system dictionary referencing sequence.

According to the present invention, where a source language sentence being inputted in the computer assisted language translating machine through a keyboard contains at least one word that requires the system to refer to a special dictionary, the dictionary specifying code specifying such special dictionary is inputted by the code input means so that the dictionary specifying code can be affixed to such word.

When a source language sentence comprising a strings of words containing the source language word affixed with the dictionary specifying code in the manner as hereinabove described is inputted in the morpheme analyzer, the source language sentence is separated into a strings of morphemes with which the discriminating means operates to determine if the dictionary specifying code has been affixed to the particular word. Should the discriminating means determines that the particular word has been affixed with the dictionary specifying code, the dictionary referencing means makes use of one of the dictionaries that is specified by the dictionary specifying code. On the other hand, should the discriminating means determines that no dictionary specifying code have been affixed to any one of the words comprising the input sentence, the dictionary referencing means make use of all of the dictionaries according to the predetermined dictionary referencing sequence. In this way, where the dictionary specifying code has been affixed to a particular word, one of the dictionaries associated with the dictionary specifying code is given priority during the dictionary referencing performed by the system to provide a target language counterpart that meets the user's desire.

The syntactic structure of the strings of the morphemes is subsequently analyzed by the syntax analyzer according to both of the information representative of the target language counterpart of the particular word affixed with the dictionary specifying code and the grammatical rules. The syntactic structure generated by the syntax analyzer is then converted by the converter into a syntactic structure of the target language.

The syntactic structure of the target language is utilized by the sentence generator for generating a translated sentence according to such syntactic structure of the target language.

BRIEF DESCRIPTION OF THE DRAWINGS

This and other objects and features of the present invention will become apparent from the following description taken in conjunction with a preferred embodiment thereof with reference to the accompanying drawings in which like parts are designated by like reference numerals and in which:

Fig. 1 is a block diagram of a preferred embodiment of a computer assisted language translating machine according to the present invention;

Fig. 2 is an explanatory diagram of the translation levels in automatic translation;

Fig. 3 is an operating structure diagram of the translation module according to the preferred embodiment;

Fig. 4 is a block diagram of the translation module;

Figs. 5 - 9 are diagrams showing the contents of each buffer shown in Fig. 4;

Fig. 10 is a dictionary referencing flow chart; and

Fig. 11 is a diagram showing a sample text in a source language inputted to the computer assisted language translating machine of Fig. 1 and the corresponding output sentence (translated sentence) in a target language.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to Fig. 1, a block diagram of a computer assisted language translating machine according to the present invention is shown. The translating machine comprises a main CPU (central processing unit) 1, a main memory 2, a CRT 3 (cathode ray tube) 3, a keyboard 4, a translation module 5, and a memory device 6 storing dictionaries, grammatical rules, and tree structure conversion rules for translation.

When a source language text is inputted to the translation module 5, the translation module 5 translates and outputs a target language counterpart. Specifically, the source language text entered from keyboard 4 is transferred to the translation module 5 under the control of the main CPU 1. The translation module 5 makes use of a plurality of storage dictionaries, grammatical rules and tree structure conversion rules stored in the memory 6 to translate the inputted source language text into the target language counterpart as will be described later. The result of this translation is temporarily stored in the main memory 2 and is displayed on the CRT 3.

Automatic translation such as performed by the translation module 5 generally consists of the analytical levels shown in Fig. 2. When the source language text is inputted as shown at the top left of Fig. 2, analysis progresses through level L1 dictionary referencing, level L2 morpheme analysis, level L3 grammatical construction, or syntactic, analysis, and son on.

Machine translation can be broadly divided into two major types according to these analytical levels. One is the pivot method in which source language sentences are analyzed through level L6 to obtain an intermediate language which is neither the source language nor the target language, but is specific to the translating machine. Analysis then proceeds through level L7 context generation, level L8 semantic generation, level L9 syntactic generation, and to level 10 morpheme generation, where the target language text corresponding to the source language text is generated.

The other is the transfer method in which the aforementioned level L2 morpheme analysis, level L3 grammatical construction analysis, level L4 semantic analysis, and level L5 context analysis are performed to obtain the internal syntax of the source language text. Next, the target language is generated after the internal syntax of the source language text is converted to the internal syntax of the target language text at the same level.

The aforementioned analysis is explained below.

* Dictionary referencing and morpheme analysis

The dictionaries stored in the memory 6 shown in Fig. 1 are referenced to break the input sentence into discrete morpheme strings (word strings), to obtain part of speech and other grammatical information and word equivalents for individual morphemes, and to analyze tense, person, and number.

* Syntactical analysis

As will be described later, the structure (syntax analysis tree) of the sentence, including relationships between words, is determined.

* Semantic analysis

Semantically correct constructions are inferred and constructed from the results of multiple syntactical analyses.

* Context analysis

The topic of the sentence is inferred, and abbreviations and ambiguities are clarified.

The translation module 5 used in the present invention shall, at the minimum, analyze the input sentence through level L3 syntactical analysis. Specifically, the translation module 5 used in the preferred embodiment shall be thought of as a translation module consisting of such component parts as shown in Fig. 3.

Referring to Fig. 4, a block diagram of the translation module 5 is shown. Furthermore, Figs. 5 through 9 show the contents stored in buffers A through E shown in Fig. 4 during the translation of, for example, an English sentence "This is a pen." to a Japanese counterpart.

The manner of how the English sentence "This is a pen." is translated into a Japanese counterpart will now be described with reference to Fig. 3 through Fig. 9.

First, the English sentence entered in the computer assisted language translating machine is stored in a buffer A in a manner shown in Fig. 5. As controlled by a translation CPU 15 according to a predetermined translation program 16, the information required for each word is obtained by the dictionary referencing morpheme analyzer 11 which makes use of the dictionaries stored in the memory 6 according to the original text stored in the buffer A, and this information is then stored in the buffer B. For example, the part of speech information, which is a part of the aforementioned required information, is stored as shown in Fig. 6. In the example shown, "this" has multiple parts of speech, a single meaning is inferred by the syntax analyzer 12 shown in Fig. 3. Syntax analyzer 12 determines the syntax analysis tree, shown in Fig. 7, which shows the relationship between individual words as defined by the dictionaries and grammatical rules stored in the memory 6, and this syntax analysis tree is stored in the buffer C. This syntax analysis tree is determined as follows, wherein specifically the grammatical rules in the memory 6 state as shown in Table 1.

Table 1

Sentence → subject, predicate
Subject → noun phrase
Predicate → verb, noun phrase
Noun phrase → pronoun
Noun phrase → article, noun

For example, the first rule states that "a sentence consists of a subject and predicate." In the following description, the syntax analysis tree is determined according to these rules.

The converter 13 shown in Fig. 3 converts the structure of the syntax analysis tree (see Fig. 7) for the source language (English) sentence to the structure of the target language (Japanese) sentence as shown in Fig. 8 using the tree structure conversion rules stored in the memory 6 in the same way as the original tree was constructed by the aforementioned syntax analyzer. The result is then stored in the buffer D of Fig. 4. A sentence generator 14 shown in Fig. 3 applies the Japanese postpositional article "WA" and auxiliary verbs appropriate to the obtained Japanese words "KORE PEN DE ARU," (Possibly reading "This, a pen." in English) and outputs the result as shown in Fig. 9 for the subsequent storage in the buffer E of Fig. 4. This Japanese sentence "KORE WA PEN DE ARU" (reading "This is a pen." in English) is outputted from the translation module 5 and stored in the main memory 2 and, at the same time, displayed on the CRT 3.

On that occasion, the dictionary referencing process to which the present invention pertains is carried out in the dictionary referencing morpheme analyzer 11 of Fig. 3 in a manner which will now be described. The dictionary referencing process is such that a dictionary specifying code specifying one of the storage dictionaries which the user desires to use during the computer assisted language translation is affixed to a particular one of words forming the source language text. With the dictionary specifying code affixed to the particular word, the system checks the word affixed with the dictionary specifying code against the storage dictionaries to select preferentially one of the storage dictionaries that is represented by the dictionary specifying code.

Fig. 10 illustrates the flowchart for the dictionary referencing process, reference to which will now be made for the detailed discussion thereof.

At step S1, a decision is made to determine if the dictionary specifying code following a source language word is contained in the target language text inputted in the computer assisted language translating machine. Where the dictionary specifying code is

affixed to the word, the program flow proceeds to step S2, but where it is not affixed to the word, the program flow proceeds to step S5 at which the system refers to one of the dictionaries specified by the dictionary specifying code affixed to the particular word.

At step S2 the system refers to the user customized dictionary, followed by step S3 at which the system refers to the technical dictionary and followed by step S4 at which the system refers to the fixed main dictionary.

Thereafter, at step S6 a decision is made to determine if the dictionary referencing has been completed. Should the result of decision at step S6 indicate "No", the program flow returns to step S1, but should it indicate "Yes", the program flow terminates.

Fig. 11 is an example of the English text inputted to the computer assisted language translating machine embodying the present invention and the Japanese counterpart outputted from this translating machine. In this example, it is assumed that information signifying that the English word "book" , when translated into a Japanese counterpart, should read "BUKKU" is registered in the user customized dictionary, whereas information signifying that the English word "book", when translated into a Japanese counterpart, should read "HON" is registered in the fixed main dictionary. Under these circumstances, when the English sentence "This is a book." as shown in INPUT 1 in Fig. 11 is entered into the translating machine embodying the present invention in the form as worded, the system automatically translates it into a Japanese counterpart sentence "KORE WA BUKKU DE ARU." (expressed in the Japanese language) with the user customized dictionary having been preferentially referred to as shown in OUTPUT 1 in Fig. 11, because no dictionary specifying code is affixed to any one of the words comprising the sentence.

On the other hand, when the English sentence "This is a kj__book." as shown in INPUT 2 in Fig. 11, wherein "kj__" represents a dictionary specifying code calling for the fixed main dictionary, is entered into the translating machine embodying the present invention in the form as worded, the system automatically translates it into another Japanese counterpart sentence "KORE WA HON DE ARU." (expressed in the Japanese language) with the fixed main dictionary having been preferentially referred to as shown in OUTPUT 2 in Fig. 11.

As hereinbefore described, according to the present invention, the dictionary specifying code affixed to at least one of the source language words which is to be translated using particular information registered in a particular one of the dictionaries before the source language sentence comprised of such words is inputted to the translating machine. With the dictionary specifying code so affixed, the morpheme analyzer 11 when performing the dictionary referencing makes an preferential access to and retrieves information from such particular one of the dictionaries to provide the information necessary that is utilized during the language translation performed by the translating machine. Accordingly, it is clear that, with the computer assisted language translating machine according to the present invention, it is possible to provide an translated output as quickly and accurately as possible.

Although the present invention has been fully described in connection with the preferred embodiment thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. For example, although in describing the preferred embodiment of the present invention, reference has been made to the example wherein the English sentence is translated into Japanese, the concept of the present invention can be equally applicable to a translation of Japanese, or any other source language, into English or any other target language linguistically different from the source language. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims unless they depart therefrom.

There are described above novel features which the skilled man will appreciate give rise to advantages. These are each independent aspects of the invention to be covered by the present application, irrespective of whether or not they are included within the scope of the following claims.

Claims

1. A computer assisted language translating machine comprising:
a morpheme analyzer for separating a source language sentence, entered in the translating machine, into morphemes with the use of dictionaries;
a syntax analyzer for analyzing the syntax of a string of the morphemes, which have been separated by the morpheme analyzer, with the use of a dictionary and grammatical rules;
a converter for converting a syntactic structure of the input sentence, analyzed by the syntax analyzer, into a syntactic structure of the target language;
a sentence generator for generating a translated sentence according to the syntactic structure of the target language converted by the converter;
a code input means for inputting a dictionary specifying code to one of words which requires the use of a particular one of the dictionaries, utilized by the morpheme analyzer for dictionary referencing, when being translated into a target language counterpart, said dictionary specifying code being used to specify such particular one of the dictionaries;
a discriminating means for determining whether or not the dictionary specifying code has been affixed by the code input means to such one of the words; and
a dictionary referencing means operable, when the discriminating means determines that the dictionary specifying code has been affixed to such one of the words, to make reference to

such particular one of the dictionaries and also operable, when the discriminating means determines that the dictionary specifying code has not been affixed to such one of the words, to make reference to all of the dictionary referencing sequence.

2. A computer assisted language translating machine having dictionary means for storing a plurality of dictionaries associating words of a source language and words of a target language, means for inputting a sentence comprising words in the source language and means for producing a corresponding sentence in the target language with reference to the dictionary means, and means responsive to the input of a dictionary specifying code associated with a said source language word to refer from the translation of that source language word to the one of said dictionaries specified by said code.

3. A translating machine according to claim 2, including dictionary priority means operable for a source language word having no such associated dictionary specifying code to refer that word to one or more of the dictionaries in a predetermined order of priority.

Fig. 1

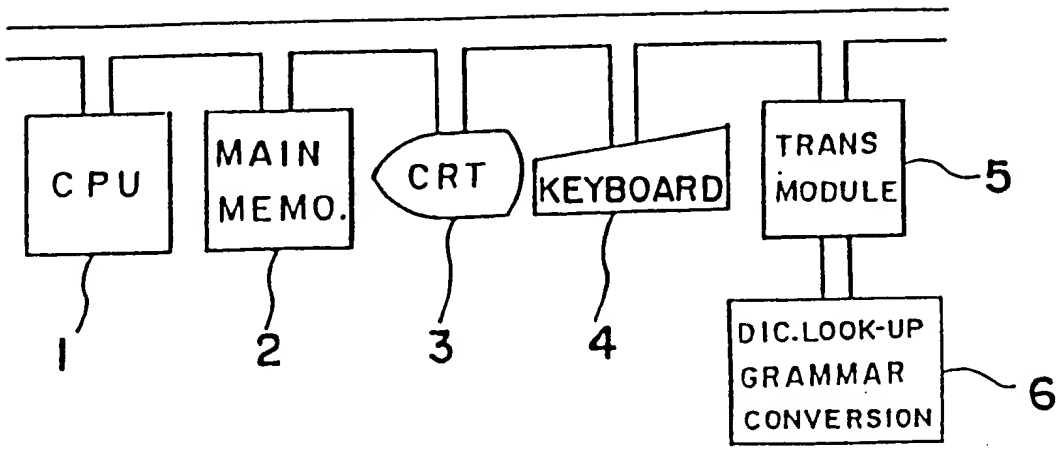
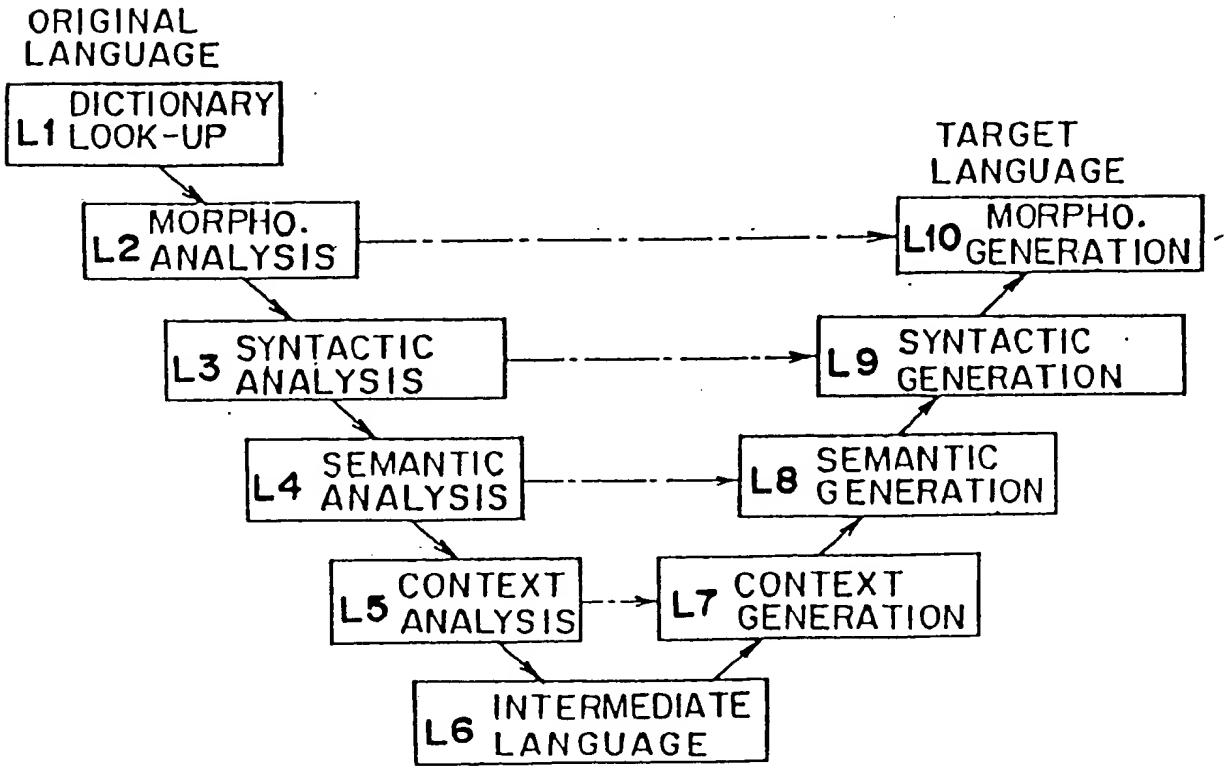

CPU
MAIN MEMO.
CRT
KEYBOARD
TRANS MODULE
5
DIC.LOOK-UP GRAMMAR CONVERSION
6
1
2
3
4

Fig. 2


ORIGINAL LANGUAGE
L1 DICTIONARY LOOK-UP
L2 MORPHO. ANALYSIS
L3 SYNTACTIC ANALYSIS
L4 SEMANTIC ANALYSIS
L5 CONTEXT ANALYSIS
L6 INTERMEDIATE LANGUAGE
L7 CONTEXT GENERATION
L8 SEMANTIC GENERATION
L9 SYNTACTIC GENERATION
L10 MORPHO. GENERATION
TARGET LANGUAGE

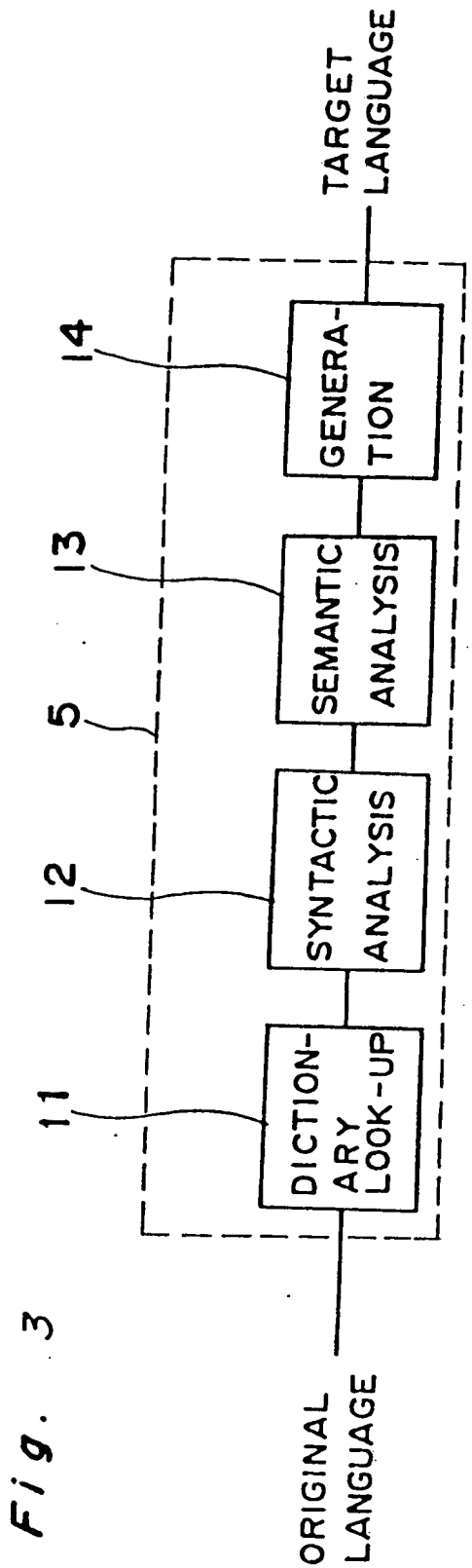

ORIGINAL LANGUAGE
DICTION-ARY LOOK-UP
SYNTACTIC ANALYSIS
SEMANTIC ANALYSIS
GENERA-TION
TARGET LANGUAGE
11
12
13
14
5

Fig. 3

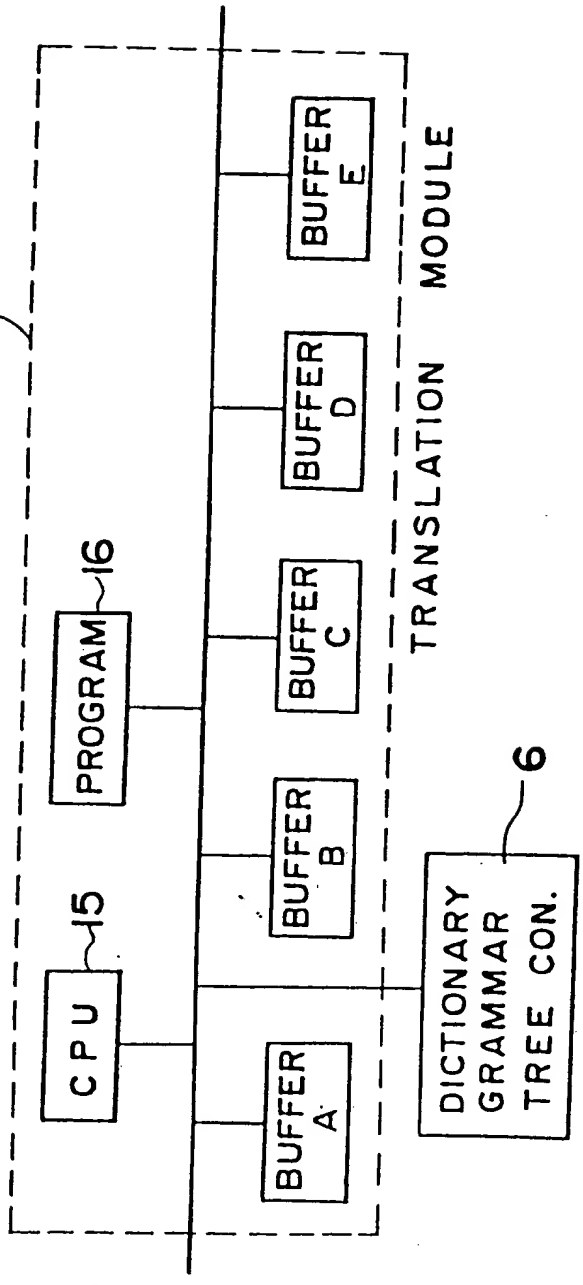

CPU
15
PROGRAM
16
BUFFER A
BUFFER B
BUFFER C
BUFFER D
BUFFER E
DICTIONARY GRAMMAR TREE CON.
6
5
TRANSLATION MODULE

Fig. 4

Fig. 5

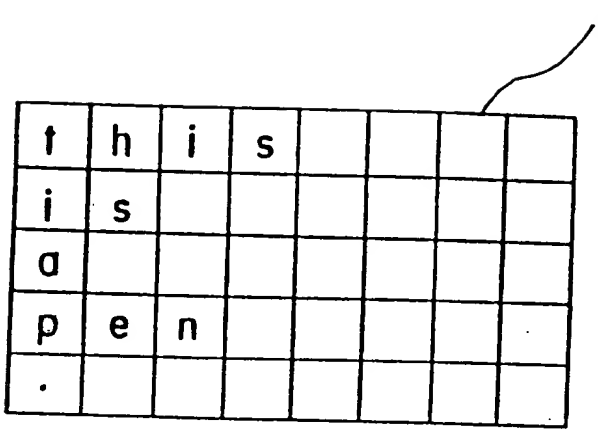


Fig. 6

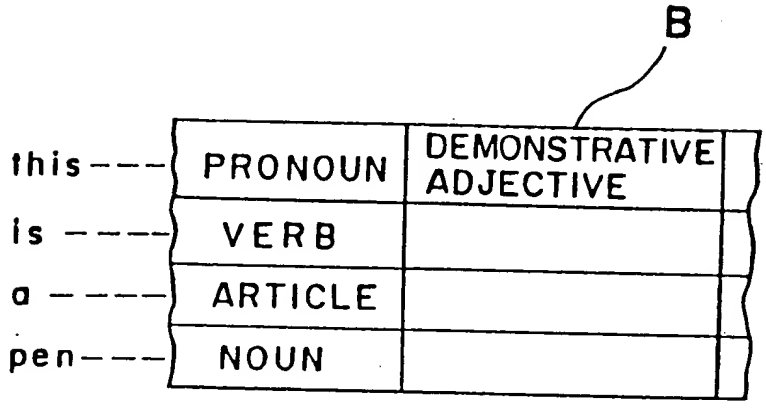


Fig. 7

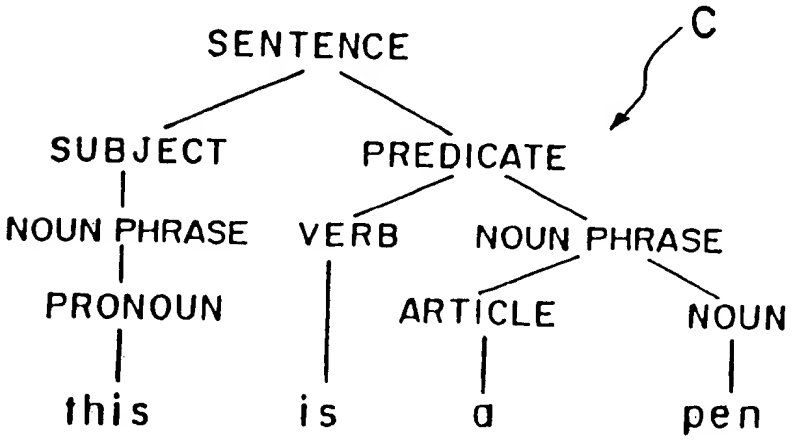


Fig. 8

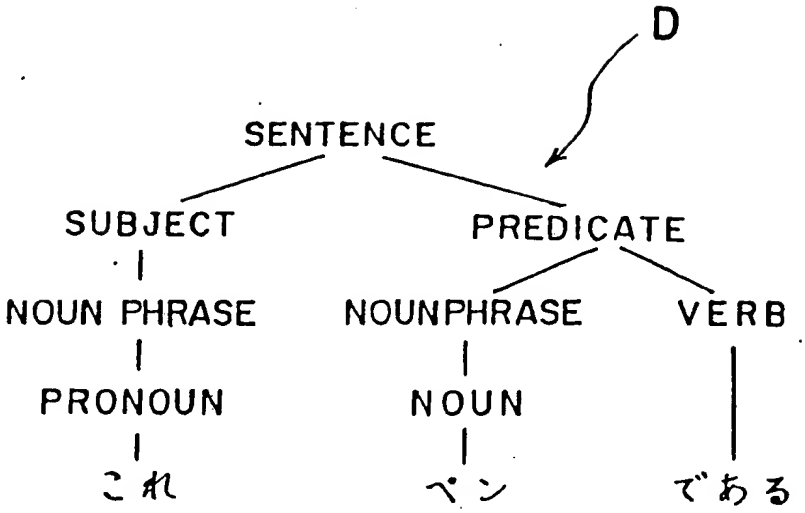


Fig. 9

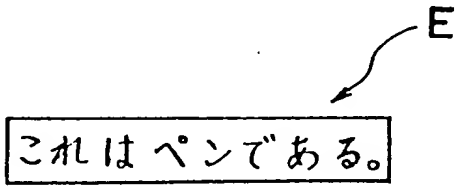
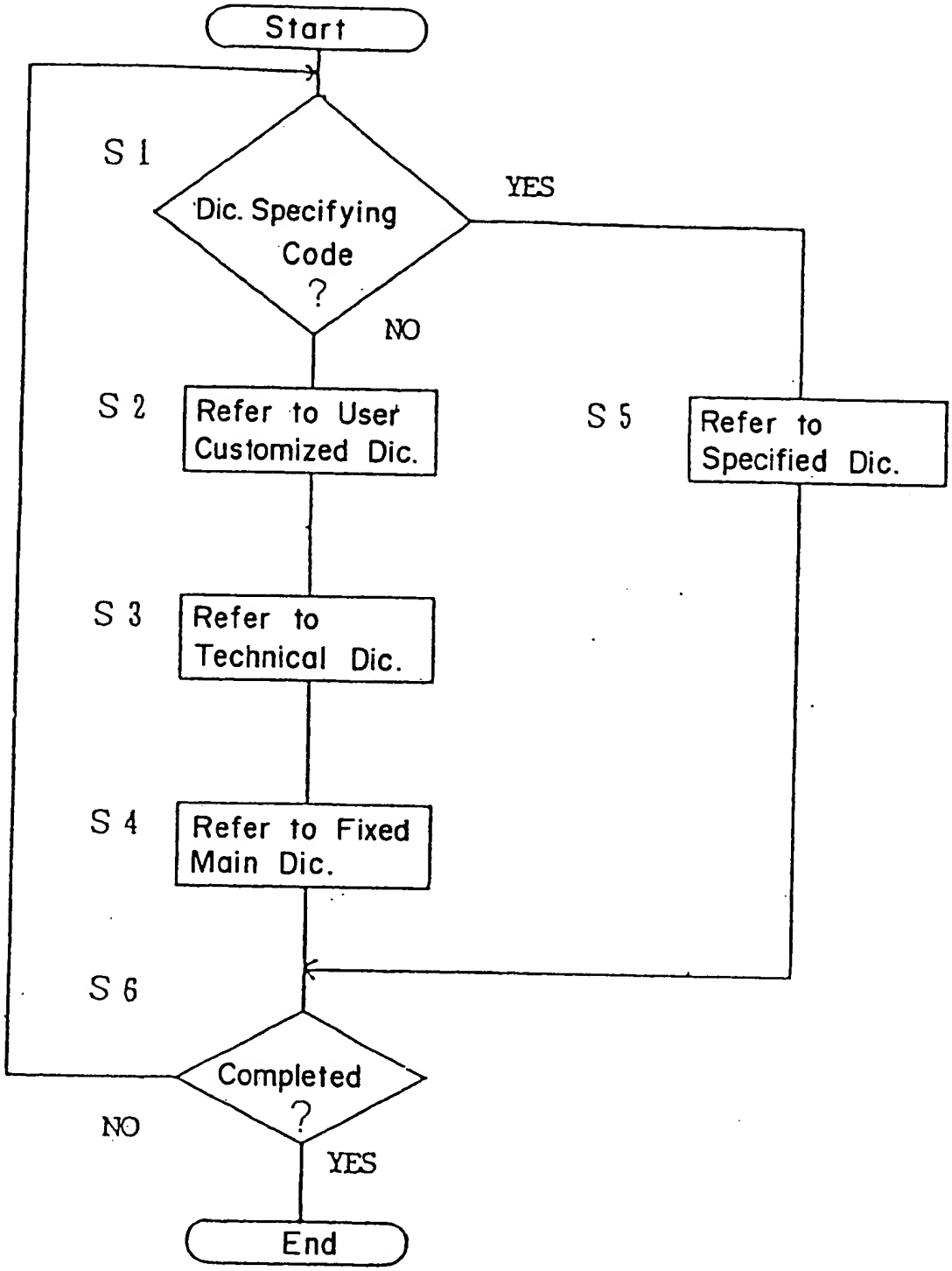


Fig. 11

INPUT 1	This is a book
OUTPUT 1	これは、ブックである。
INPUT 2	This is a kj_book.
OUTPUT 2	これは、本である。

Fig. 10


Start
S 1
Dic. Specifying Code ?
YES
NO
S 2
Refer to User Customized Dic.
S 3
Refer to Technical Dic.
S 4
Refer to Fixed Main Dic.
S 5
Refer to Specified Dic.
S 6
Completed ?
NO
YES
End